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Design, Development and Test of Engineering Models of Tethered Nanosatellites to Observe the Solar Corona

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Abstract

The present work, which is based on a cooperative effort between the Group of Space Solar Physics at the Osservatorio Astronomico di Torino (OATo), and the AeroSpace Systems Engineering Team (ASSET), at Politecnico di Torino, is part of a wider research program known as “Studies of Solar System Exploration,” funded in 2007 by ASI (Italian Space Agency). The request made by OATo was the development of the capability of taking pictures of the solar corona by means of simple and low cost optical components. ASSET developed the concept of a system consisting of two low-cost tethered nanosatellites, the Occulting and the Observing. The research program, which ended in 2010, envisaged both the conceptual design of the system and the development of experimental test-benches to test critical technologies. The following tests were performed in the Aerospace Systems Laboratory: attitude determination and control of the Occulting engineering model on a frictionless table; acquisition and transmission of pictures from the Observing engineering model to the control station; rotation of the Observing engineering model on a frictionless table; translation of the Observing engineering model on a frictionless table; and separation between the Occulting and Observing engineering models. This article summarizes the research activities carried out within the program and the primary results obtained.

1. Introduction

In the framework of the research project “Studies of Solar System Exploration,” funded by Italian Space Agency (ASI), the Group of Space Solar Physics at the Osservatorio Astronomico di Torino (OATo) and the

AeroSpace Systems Engineering Team (ASSET) at Politecnico di Torino began a cooperative study to develop the capability of taking pictures of the solar corona by means of simple and low-cost cameras, at the request of OATo. The study started in 2007 and ended in 2010.

ASSET developed the concept of a tether corona-graph system, i.e. a system consisting of two tethered nanosatellites, named respectively the “Occulting Satel-

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